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(71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE).

(72) Inventors: BERG, Ingvar; Gårdsätter Östergård, S-590 52 Nykil (SE). SKOG, Robert; Gullivegränd 7, S-165 76 Hässelby (SE).

(74) Agent: MAGNUSSON, Monica; Ericsson Radio Systems AB, Patent Unit Radio Access, S-164 80 Stockholm (SE).

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(54) Title: METHOD AND APPARATUS FOR MAPPING AN IP ADDRESS TO AN MSISDN NUMBER WITHIN A WIRELESS APPLICATION PROCESSING NETWORK
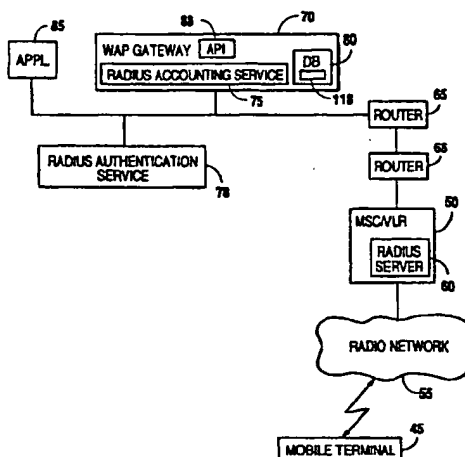
(57) Abstract: A system and method for associating an MSISDN of a mobile terminal (45) with a temporarily assigned IP address is disclosed. A first server (60) located within a wireless communications network generates and transmits a start packet to a WAP network (10) responsive to an access request by a mobile terminal (45). The start packet includes the MSISDN of the mobile terminal (45) and an assigned IP address. A second server (70) within the WAP network (10) extracts the MSISDN in the IP address from the received start packet and stores this information together within a database (80). When a WAP application (85) is utilized, the MSISDN may be determined from the database (80) and placed in an HTTP-header of packets to the WAP application (85). The database (80) may be periodically updated based upon changes between the association of the MSISDN and the assigned IP address. This process may be used for a number of things within a network including authentication, billing and personalization.

METHOD AND APPARATUS FOR MAPPING AN IP ADDRESS TO AN MSISDN
NUMBER WITHIN A WIRELESS APPLICATION PROCESSING NETWORK

5   RELATED APPLICATIONS

          This application claims priority from and incorporates
herein by reference the entire disclosure of U.S. Provisional
Application Serial No. 60/188,437, filed March 10, 2000

10   BACKGROUND OF THE INVENTION
          Technical Field of the Invention
          The present invention relates to wireless application
protocol (WAP) systems, and more particularly, to the mapping
of temporary IP addresses to established MSISDN numbers.

15   Description of Related Art
          Wireless application protocol (WAP) is positioned at the
conversions of two rapidly evolving network technologies,
wireless data and the Internet. Both the wireless data market
and the Internet are growing very quickly and are continuously

20   reaching new customers. The explosive growth of the Internet
has fueled the creation of new and exciting information
services. Most of the technology developed for the Internet
has been designed for desktop and larger computers and medium
to high bandwidth networks.

25   Hand held wireless devices present a more constrained
computing environment compared to desktop computers. They have
less powerful CPU's and memory than desktop systems.
Similarly, wireless data networks present a more constrained
communications environment compared to wired networks.

30   Wireless networks have fundamental limitations with respect to
power, available spectrum and mobility. The WAP specification
has been developed to address mobile network characteristics
by adapting existing network technologies for the Internet to
the specialized requirements of hand-held wireless data

35   devices.

          Access to a wireless application protocol system utilizing
WAP technologies is provided via a WAP gateway node. The WAP
gateway node is normally located within an Internet service
provider (ISP) providing access to the Internet for mobile

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terminals. However, the WAP gateway node may alternatively be provided by a mobile services operator. In order to obtain access to the WAP gateway node, a user must be authenticated. There are two possible authentication points for a user. The first authentication point is during setup of a data call. This authentication is handled by the integrated access system (IAS) located within a mobile switching center utilized by the mobile terminal and/or a remote authentication dial-in user service (RADIUS) authentication server located in the WAP network.

The user may also be authenticated when accessing particular servers within the WAP network. This manner of authentication may be handled in two different ways. Proxy authentication may be used wherein the WAP gateway returns a status code of "407" to a WAP browser. This initiates the same type of basic authentication as occurs for a hypertext transport protocol (HTTP) message. A user ID and password are entered by the user in response to this status code and this data is included within every IP packet from the browser.

A WAP gateway supports several different types of bearer messages, for example, IP, SMS, USSD, etc. A MSISDN is used within the WAP gateway to determine if a user is allowed to use the WAP gateway node, to charge for using the WAP gateway node, and to enable charges for specific content to be transmitted. If SMS or USSD bearer protocols are used, the MSISDN is always included within the data packet and this poses no identification problems for the WAP gateway. However, when using the IP protocol, the integrated access system within the mobile switching center allocates a temporary IP address to the mobile terminal. This IP address is included within messages transmitted to the WAP gateway. The WAP gateway has no way at present to determine the MSISDN number associated with a particular IP address. Thus, some manner for enabling the WAP gateway to associate the temporary IP addresses with a fixed MSISDN number is desired.

SUMMARY OF THE INVENTION

The present invention overcomes the foregoing and other problems with a system and method for associating an MSISDN number of a mobile terminal with a temporarily assigned IP address for use with authentication, billing and personalization processes in a network. In response to a wireless network access request by a mobile terminal, a first server located within the wireless network, generates a start packet. The start packet contains an MSISDN of the mobile terminal and an IP address assigned to the mobile terminal by the first server. The start packet is transmitted to a second server within a wireless application protocol network wherein a second server extracts the MSISDN and the assigned IP address from the start packet and stores the MSISDN and the assigned IP address within a database. The database enables storage of the MSISDN and the IP address together such that the database may be accessed using an interface to determine an MSISDN associated with the IP address.

The first server may also generate stop packets responsive to disconnection of the mobile terminal from the wireless network. The stop packet also contains the MSISDN and assigned IP address of the mobile terminal and, responsive to receipt of the stop packet, the second server determines the MSISDN and IP address from the stop packet and deletes these entries from the database.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the method and apparatus of the present invention may be obtained by reference to the following Detailed Description when taken in conjunction with the accompanying Drawings wherein:

FIGURE 1 is a block diagram illustrating a WAP network;

FIGURE 2 is a block diagram of a WAP network incorporating the IP to MSISDN mapping technique of the present invention;

FIGURE 3 is a signaling diagram illustrating a request of a particular WAP application by a mobile terminal; and

FIGURE 4 is a signaling diagram illustrating the

termination of a PPP connection between a mobile terminal and
the WAP gateway.

DETAILED DESCRIPTION

Referring now to the drawings, and more particular to
FIGURE 1, there is illustrated a WAP network 10. A micro
browser 15 within a wireless terminal 20 enables the user to
access world wide web servers 25 on the Internet via a WAP
gateway server 30. The WAP gateway 30 comprises a protocol
gateway which translates requests from a WAP protocol (WSP,
WTP, WTLS and WDP) to a WWW protocol (HTTP and TCP/IP). This
is accomplished via content encoders and decoders 35 within the
WAP gateway server 30.

Referring now to FIGURE 2, there is illustrated a block
diagram of a system which utilizes radius accounting messages
as a manner for mapping IP addresses to an MSISDN number.
While the following description of mapping an IP address to an
MSISDN number is done with respect to an authentication
process, the system and method may also be used with a billing
process, personalization process, etc. The system includes a
mobile terminal 45 which may comprise a mobile telephone,
portable computer, personal data assistant or any other mobile
electronic device capable of communicating with a MSC/VLR 50
via a wireless radio network 55. It should be well understood
by one skilled in the art that the wireless radio network for
communicating between the mobile terminal 45 and MSC/VLR 50
would consist of a base transceiver station, base station and
other components necessary within a wireless radio network.

While the described embodiment uses RADIUS Accounting
messages to carry out the described invention, other systems
performing similar functions may be used. When a client is
configured to use RADIUS Accounting, at the start of service
delivery the client will generate an Accounting Start packet
describing the type of service being delivered and the user to
whom the service is being delivered. The Accounting start
packet is sent to the RADIUS Accounting server, which will send
back an acknowledgment that the packet has been received. At

the end of service delivery the client will generate an
Accounting Stop packet describing the type of service that was
delivered and optionally statistics such as elapsed time, input
and output octets, or input and output packets. The client
5   will send that to the RADIUS Accounting server, which will send
back an acknowledgment that the packet has been received. By
the present invention, RADIUS is used for transmitting IP-
address and MSISDN at session start. Other types of
information can also be transmitted, e.g., by using RADIUS
10 Accounting for billing or personalization procedures. Other
systems capable of transmitting the IP address and MSISDN
information between the networks might also be used in place
of a RADIUS system.

The MSC/VLR 50 includes a remote authentication dial-in
15 user service (RADIUS) server 60 configured to transmit a RADIUS
accounting message from the MSC/VLR 50 to the WAP gateway 70.
The RADIUS accounting messages are transported to the WAP
gateway 70 through routers 65 interconnecting the MSC/VLR 50
and the WAP gateway 70. A RADIUS accounting server 75 is
20 located within the WAP gateway 70. The RADIUS accounting
server 75 is responsive to the received RADIUS accounting
messages from the MSC/VLR 50 and upon receipt of these messages
updates a mapping session database 80 within the WAP gateway
70. The mapping session database 80 includes a plurality of
25 storage locations for an assigned temporary IP address and an
associated MSISDN of the mobile terminal 45.

The RADIUS accounting messages comprise packets of data
which describe the type of service being delivered, and the
user to which the service is to be delivered. Information in
30 the packet includes among other things, the MSISDN number,
number of frames, and the IP address of the mobile terminal
45. The information within a packet relating to IP address and
MSISDN number is used to update the database 80 within the WAP
gateway 70. RADIUS accounting messages indicating the stoppage
35 of a connection between a mobile terminal 45 and the WAP
gateway 70 cause the database 80 to be updated such that the
MSISDN and IP address for the mobile terminal are no longer

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stored and associated together in the database.

Once a mobile terminal 45 has been properly authenticated by the WAP gateway 70 and the IP address and the IP address and MSISDN of the mobile terminal stored in the database 80, the mobile terminal may access applications 85 within the WAP network. The RADIUS authentication server, in collaboration with a translation application program (API) interface 88, provides a conduit for the database 80, enabling applications to access and determine a MSISDN associated with an IP address for the mobile terminal 45.

Referring now to FIGURE 3, there is provided a first example of a signaling diagram utilizing the method for mapping a MSISDN number to a temporarily assigned IP address for a mobile terminal 45 accessing a WAP gateway 70. The process illustrated in FIGURES 3 describes when a mobile terminal 45 requests use of a WAP application 85 residing upon a web server on the Internet. The mobile terminal 45 transmits a message 100 to the access server 60 in order to establish a connection to the access server using the point-to-point protocol (PPP). Before establishing a connection with the mobile terminal 45, the access server 60 performs an authentication process wherein the mobile terminal 45 transmits authentication information including the PPP User ID of the mobile terminal and a password to the access server 60 using a password authentication procedure (PAP).

The access server 60, residing within the mobile switching center 50 (FIGURE 2) generates an access request message 105 for transmission to the RADIUS Authentication server 78 located within the WAP gateway 70. The access request message 105 includes the PPP User ID and password transmitted to the access server 60 by the mobile terminal 45. The access request message comprises a request from the access server 60 to the RADIUS server 75 requesting user access to a particular site. The RADIUS server 75 replies to the access server 60 with an access accept message 110 to indicate that access has been granted to the mobile terminal 45.

Next, a PPP connection is established between the access

server 60 and the mobile terminal 45. IP packets are
transmitted over the connection. The only information included
about the sender within the IP packets transmitted over the PPP
connection is the IP address of the source mobile terminal 45.
5   The IP address cannot alone be used as a user ID since the IP
address is dynamically allocated to the mobile terminal 45 by
the access server 60 or the RADIUS server 75 during the PPP
connection setup.

To overcome this problem, the IP address and the MSISDN
10   of the mobile terminal 45 are transmitted over the PPP
connection from the access server 60 to the WAP gateway 70 as
an accounting request message 115 to enable mapping between
these identifiers. The IP address and the MSISDN are stored
as a record 118 within the mapping session database 80 within
15   the WAP gateway 70. The WAP gateway 70 replies to the
accounting request message 115 by means of a mandatory
accounting response message 120 to the access server 60 using
the RADIUS protocol. Once this connection is established, the
user may generate a request 130 for access to a particular WAP
20   application 85 ("service") on a web server. This request is
forwarded from the mobile terminal 45 to the WAP gateway 70.
The WAP gateway 70 forwards the mobile terminal request 138 to
the requested application 85. The WAP gateway 70 may determine
the IP address of the mobile terminal 45 by examining the IP
25   packet header to determine the IP address of the mobile
terminal. The MSISDN of the mobile terminal 45 is determined
by examining the mapping session database 80 and the associated
IP address via the application program interface 88. The
determined MSISDN is placed in an HTTP header of packets used
30   to contact the WAP application 85.

Referring now to FIGURE 4, there is illustrated a
signaling diagram wherein a mobile terminal 45 with an
established PPP connection to the access server 60 terminates
the PPP connection. Initially, the mobile station 45
35   terminates at 135 the PPP connection with the access server 60.
In response to the termination of the PPP connection, the
access server 60 transmits an accounting request stop message

140 to the WAP gateway 70. This request includes the MSISDN and IP address of the mobile terminal 45. In response to the accounting request stop message 140, the WAP gateway 70 removes the entry within the mapping session database 80 associated

5   with the MSISDN number and IP address. The WAP gateway 70 responds to the accounting request stop message by means of an accounting response message 145 acknowledging cancellation of the PPP connection.

The previous description is of a preferred embodiment for

10   implementing the invention, and the scope of the invention should not necessarily be limited by this description. The scope of the present invention is instead defined by the following claims.

WHAT IS CLAIMED IS:

1.   A method for associating a MSISDN with a temporary IP address within a WAP network (10), comprising the steps of:

transmitting a start packet to a server associated with the WAP gateway node (70), the start packet including a MSISDN and a temporary IP address of the mobile terminal (45); and

storing the MSISDN and the temporary IP address in a database (80) wherein the MSISDN and the temporary IP address are associated with each other responsive to the start packet.

2.   The method of Claim 1, further comprising the steps of:

transmitting a stop packet to the server associated with the WAP gateway node (70), the stop packet including the MSISDN and the temporary IP address of the mobile terminal (45); and

deleting the stored MSISDN and the temporary IP address from the database (80) responsive to the stop packet.

3.   The method of Claim 2, wherein the step of transmitting further comprises the step of configuring an access server (60) to transmit an account stop packet as the stop packet.

4.   The method of Claim 2, wherein the step of transmitting further comprises the step of configuring a RADIUS server (78) to transmit an account stop packet as the stop packet.

5.   The method of Claim 4, further comprising the step of transmitting an acknowledgment packet form the server responsive to the stop packet.

6.   The method of Claim 1, wherein the step of transmitting further comprises the step of configuring an access server (60) to transmit starting packet as the start

5   packet.

7.   The method of Claim 1, wherein the step of transmitting further comprises the step of configuring a RADIUS server (78) to transmit an account starting packet as the start

10   packet.

8.   The method of Claim 7, further comprising the step of transmitting an acknowledgment packet from the server responsive to the start packet.

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9.   The method of Claim 1, further comprising the step of determining an MSISDN of the mobile terminal (45) by accessing the database (80).

20   10.   The method of Claim 9, further comprising the steps of:

placing the determined MSISDN into an http header; and

transmitting the http header to a WAP application

25   with a data packet.

11.   The method of Claim 1, wherein the method is used in at least one of an authentication process, a billing process, and a personalization process.

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12. A system for associating a MSISDN of a mobile terminal (45) with a temporarily assigned IP address, comprising:

a first server (60) associated with a wireless network for generating a start packet responsive to an access request from a mobile terminal (45), the start packet containing a MSISDN provided by the mobile terminal (45) and an IP address assigned to the mobile terminal (45) by the first server (60).

a database (80) associated with a WAP network (10) having storage locations for a plurality of MSISDNs and associated assigned IP addresses; and

a second server (70) associated with the WAP network (10) for extracting the MSISDN and the IP address from the start packet and storing the MSISDN and the IP address in the database (80).

13. The system of Claim 12, wherein the first server (60) is located within a mobile switching center (50) of the wireless network.

14. The system of Claim 12, wherein the second server (70) is located within a WAP gateway of the WAP network (10).

15. The system of Claim 12, wherein the first server (60) comprises an integrated access system server.

16. The system of Claim 12, wherein the second server (70) comprises a RADIUS accounting server (78).

17. The system of Claim 12, wherein the second server (70) further includes a translation application program interface (88) for enabling access to the database (80) by a WAP application (85).

18.   The system of Claim 12, wherein the second server
(70) is configured to:

receive the session start packet from the first
server (60) in response to an access request from the mobile
terminal (45);

store the MSISDN number and the temporary IP-address
in the database (80) associated with the WAP gateway; and

update the mapping session database (80) by removing
the MSISDN number and the temporary IP-address in response to
a receipt of a stop packet.

19.   The system of Claim 12, wherein the first server (60)
further generates a stop packet responsive to termination of
a connection with the mobile terminal (45).

20.   The system of Claim 12, wherein the second server
(70) is further configured to:

place the determined MSISDN into an http header; and
transmit the http header to a WAP application (85)
with a data packet.

21.   The system of Claim 12, wherein the system associates
a MSISDN of a mobile terminal (45) with a temporarily assigned
IP address during at least one of an authentication process,
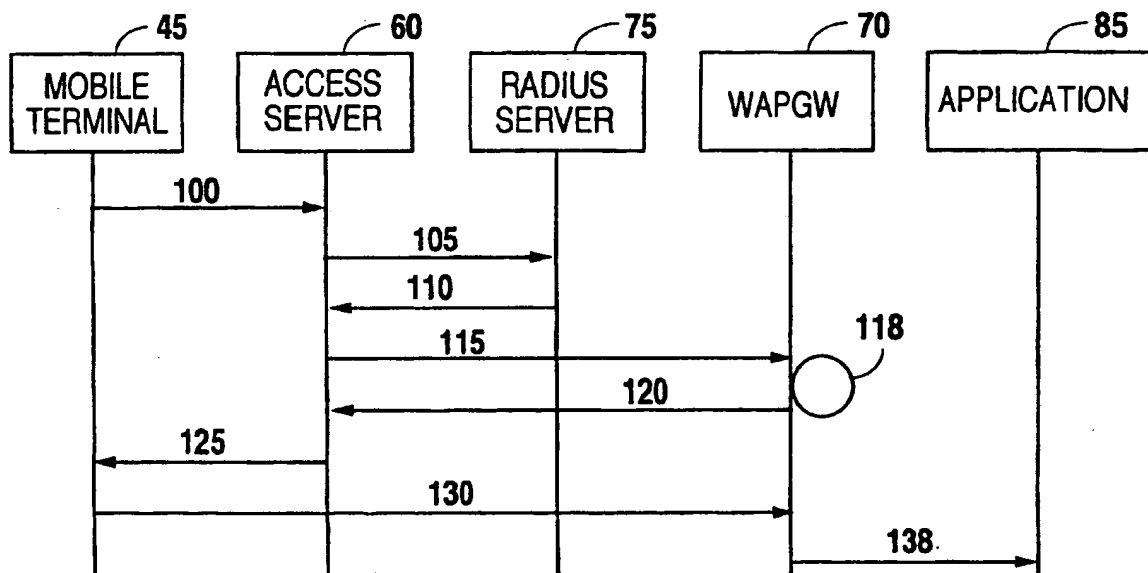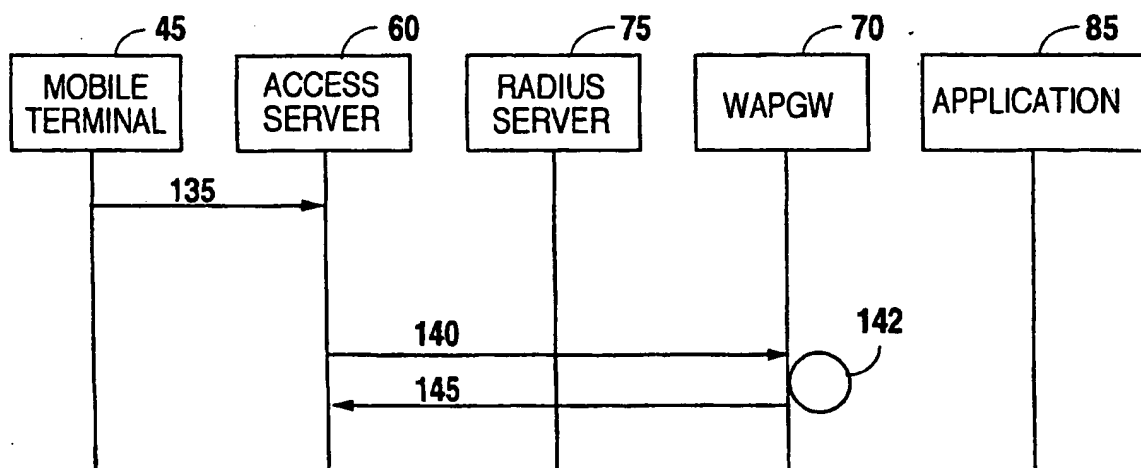a billing process and a personalization process.

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Fig. 1
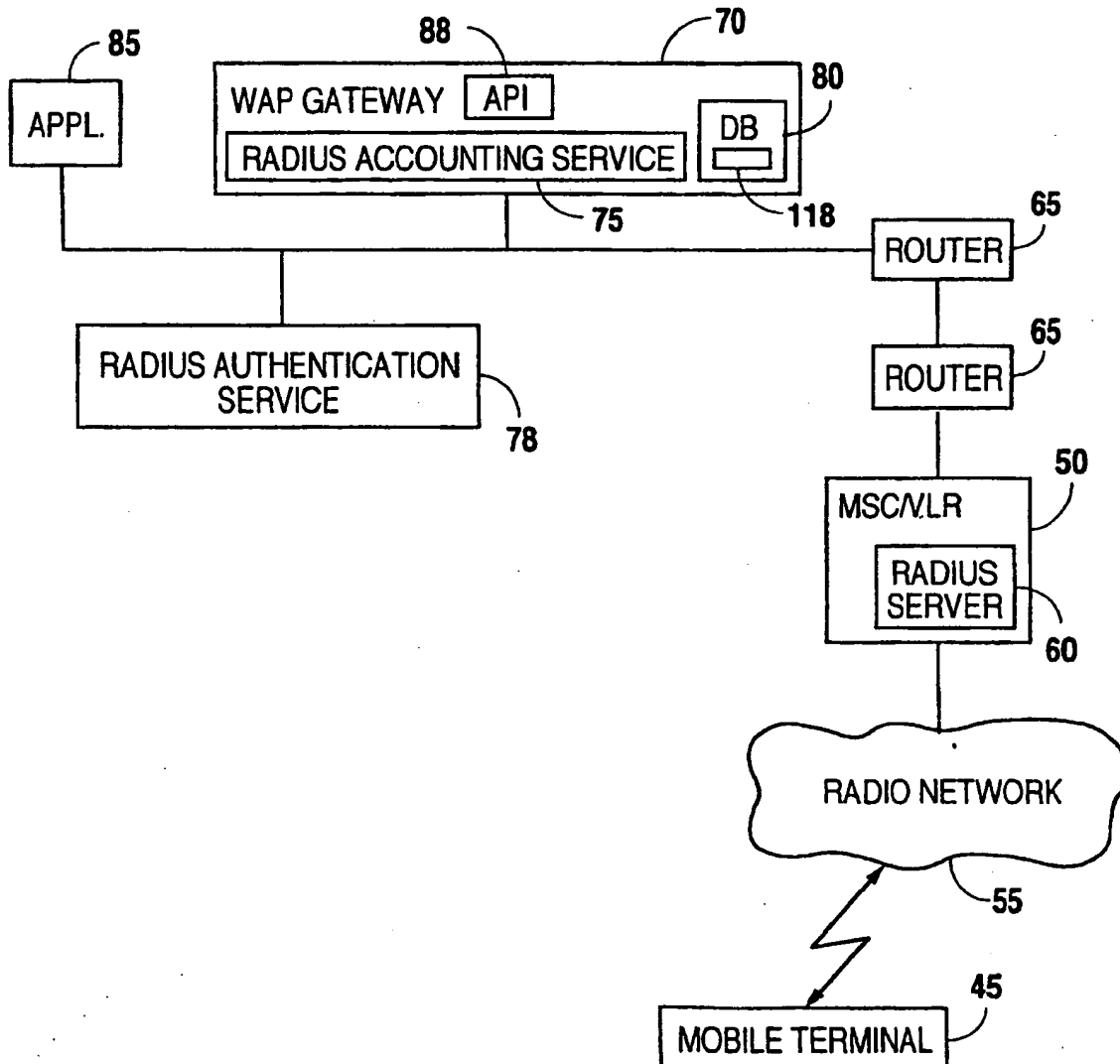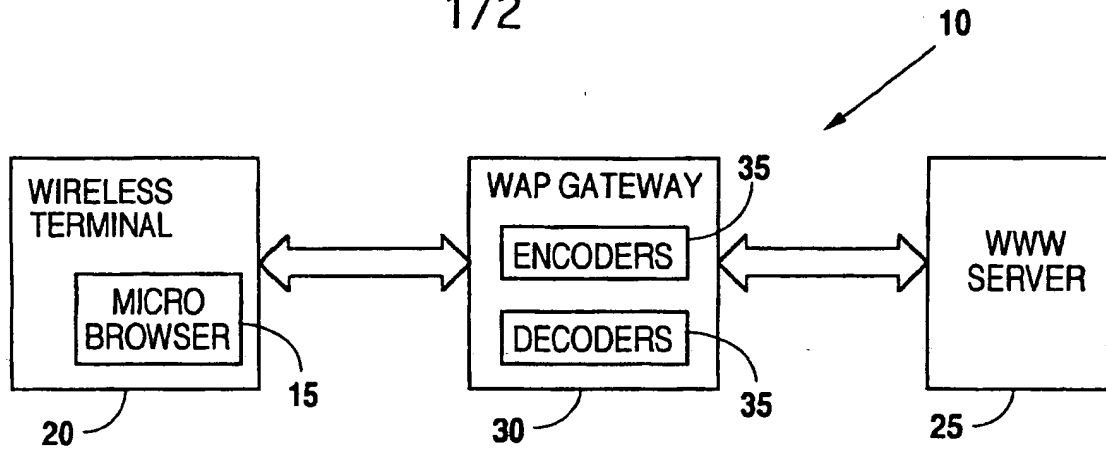
Fig. 2

Fig. 3

Fig. 4

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   H04L29/12   H04L29/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX, IBM-TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category°	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	WO 00 04679 A (AT MOBILE COM CORP) 27 January 2000 (2000-01-27) abstract page 1, line 1-30 page 3, line 1-19 page 4, line 1 -page 10, line 2 figures 3-5 ___ -/--	1,9, 12-14 2,6,7, 10,11, 15-21

[X] Further documents are listed in the continuation of box C.	[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 July 2001	17/07/2001

Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Authorized officer Lievens, K

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No
Y	HOOGENBOOM M ET AL: "Security For Remote Access And Mobile Applications" COMPUTERS & SECURITY. INTERNATIONAL JOURNAL DEVOTED TO THE STUDY OF TECHNICAL AND FINANCIAL ASPECTS OF COMPUTER SECURITY,NL,ELSEVIER SCIENCE PUBLISHERS. AMSTERDAM, vol. 19, no. 2, February 2000 (2000-02), pages 149-163, XP004204675 ISSN: 0167-4048 page 154, left-hand column, line 269 -page 155, left-hand column, line 10 figures 5,6 ---	1,9, 12-14
A	US 5 974 453 A (ANDERSEN DAVID B ET AL) 26 October 1999 (1999-10-26) abstract column 1, line 1 -column 2, line 49 column 3, line 1 -column 8, line 63 ---	1-3,6, 9-12,15, 18-21
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